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(54) Automatic parking disk

(57) An automatic parking disk, comprising a time measurement device, means for displaying the measured time, autonomous power supply means, and electronic control means comprising sensor means for detecting the state of motion of a vehicle; the display means display the current time if the sensor means indicate that the vehicle is moving, and the time when the vehicle was stopped if the sensor means indicate that the vehicle is currently motionless.

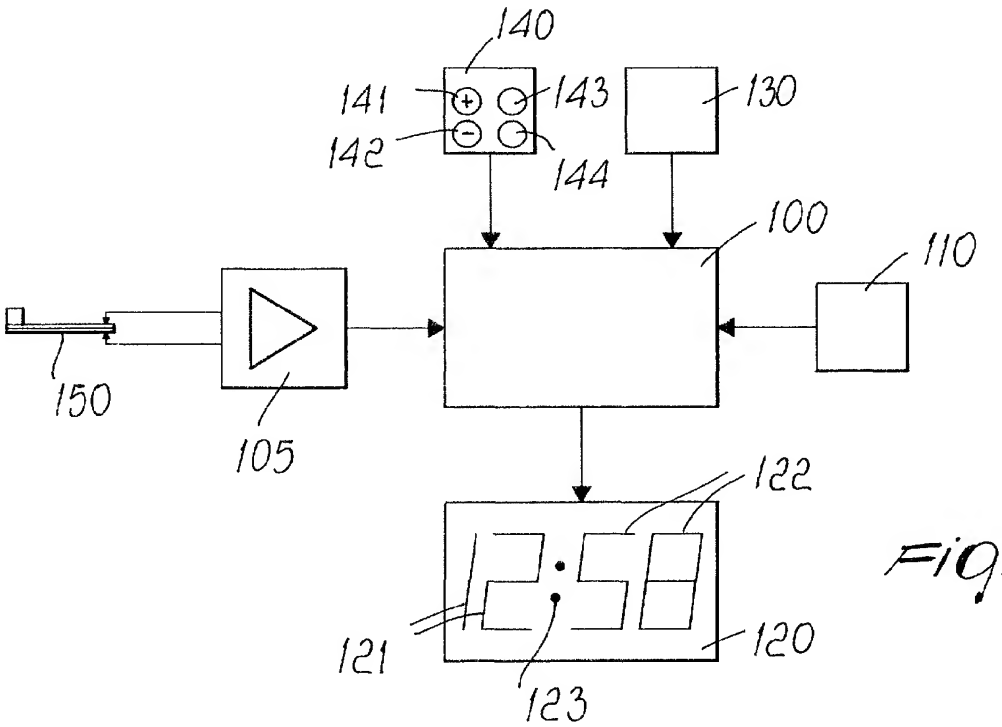

Fig. 1

EP 1 221 676 A2

Description

[0001] The present invention relates to an automatic parking disk provided with a time measurement device, display means, and electronic control means that comprise sensor means suitable to determine the state of motion of the vehicle.

[0002] It is known that street congestion often induces the municipal administrations of the cities most severely affected by the problem of car overcrowding to control traffic with various measures, including the creation of time-limited parking areas also known as parking-disk areas, in which a vehicle can be parked only for a maximum preset time, usually between twenty minutes and a few hours. In these parking areas the driver is required to clearly display on the dashboard of his vehicle a parking disk, which is generally set manually and indicates the arrival time of the vehicle and the beginning of the parking period.

[0003] However, due to laziness, distraction or unawareness, drivers often fail to notice the signs that indicate these areas, and said signs are frequently poorly positioned and scarcely visible or even hidden; accordingly, the vehicle owner is required to pay a possibly hefty fine.

[0004] Since it is therefore desirable to solve this situation, the current state of the art proposes devices that attempt to interpret the state of motion of the vehicle and to automatically display the parking start time when the vehicle is motionless. However, these devices have considerable drawbacks that have significantly limited their diffusion. In particular, they require connections to the electric circuitry of the vehicle, making it accordingly complicated or at least inconvenient to perform their installation, which requires the intervention of a car electrician or of a specialist. Secondly, these devices are powered by the battery of the car and thus constantly consume energy intended for the primary functions of said vehicle. Another drawback consists of the method for detecting the state of motion of the vehicle, which is based on the position of the ignition key or on the presence of people on board the vehicle. In the first case, it is in fact evident that in this approach inhibits all the other functions of the vehicle that require the supply of power from the battery and the correct setting of the key to the ignition position, such as for example switching on the headlights or in some cases using the vehicle's radio. In the second case, the detection of people on board the vehicle, which is usually performed by means of infrared sensors or heat detectors, does not necessarily correspond to the state of motion of the vehicle. Moreover, the sensor must be orientated so as to affect the body of the driver, with evident positioning constraints.

[0005] Finally, detecting the state of motion of a vehicle requires greater accuracy than proposed by the current art.

[0006] The aim of the present invention is therefore to overcome the above described problems, by providing an automatic parking disk that is capable of detecting correctly the state of motion of a vehicle and of automatically activating itself without requiring any manual intervention, said parking disk further overcoming the new problems that arise from the use of the automatic devices that constitute the current art.

[0007] Within this aim, an object of the present invention is to provide an automatic parking disk that requires no installation effort and no technical intervention on the vehicle on which it will be used.

[0008] Another object of the present invention is to provide an automatic parking disk that can be easily used by the user and does not require repeated time adjustments.

[0009] Another object of the present invention is to provide an automatic parking disk that is tough and accurate but has low costs.

[0010] This aim and these and other objects that will become better apparent hereinafter are achieved by an automatic parking disk, which comprises a time measurement device, means for displaying the measured time, and electronic control means comprising sensor means for detecting the state of motion of a vehicle, characterized in that said display means display the current time if said sensor means indicate that the vehicle is moving, the time when the vehicle was stopped if said sensor means indicate that the vehicle is motionless, and in that the electronic control means activate freezing of the display after a time t1 for verifying the motionless state of the vehicle, and activate unfreezing of the display after a time t2 for verifying the state of motion of the vehicle. Conveniently, the display means comprise a liquid-crystal digital screen and can display the measured time both from the outside and optionally from the inside.

[0011] Advantageously, the sensor means can comprise a ceramic piezoelectric sensor, particularly a barium titanate sensor formed by two mutually opposite elements of the bimorph type or by a cylindrical or disk-like body, which is inserted in a window formed by milling inside a printed circuit, with which it is rigidly coupled by soldering, and can be calibrated according to the type of vehicle.

[0012] Conveniently, the freezing and unfreezing of the display occur after a certain period of time that is suitable to assuredly determine the state of motion of the vehicle. In particular, the variation of the state of the vehicle from "motionless" to "moving" is determined when the sensor detects one or more pulses for a first predefined number of consecutive timeslots and the variation of the state of motion of the vehicle from "moving" to "motionless" is determined when no pulses are detected for a second number of consecutive timeslots.

[0013] Conveniently, the automatic parking disk comprises means for resetting and adjusting the current time or alternatively means for automatic time adjustment controlled by a radio-frequency time signal.

[0014] Advantageously, the automatic parking disk

can be accommodated in a slider-like support fixed to the windshield of the vehicle or in another convenient point.

[0015] Furthermore, the automatic parking disk is advantageously provided with autonomous power supply means, for example one or more 1.5- or 3-volt silver oxide batteries.

[0016] Further characteristics and advantages of the present invention will become better apparent from the following detailed description, given by way of non-limitative example and shown in the accompanying figures, wherein:

Figure 1 is a schematic block diagram of the components of the device according to the present invention;
Figure 2 is a perspective view of the device according to the present invention, illustrating the rear part of the device and a support in which it can be inserted;
Figure 3 is another perspective view of the device according to the present invention, illustrating the front part;
Figure 4 is a front view of the device according to the present invention, inserted in the seating support of Figure 2; and
Figure 5 is a block diagram of a preferred embodiment of a sensor used in the device according to the present invention;
Figure 6 is a view of a preferred method for improving the accuracy of the definition of the state of motion of a vehicle;
Figure 7 is a schematic view of a second preferred embodiment of a sensor used in the device according to the present invention.

[0017] With reference to Figure 1, the automatic parking disk is constituted by electronic control means 100 that are connected to a time measurement device 110, means 120 for displaying the measured time, power supply means 130, adjustment means 140, and sensor means 150.

[0018] The operation of the device is as follows. The automatic parking disk is initially activated by connecting appropriate power supply means 130, for example one or more batteries, and is adjusted by acting on the adjustment means 140 until the screen 120 indicates the correct time. At this point, the automatic parking disk can be positioned behind the windshield or in another appropriate place without requiring any further manual intervention. The electronic control means 100 are programmed so as to freeze the digits displayed by the display means 120 on the time when parking begins, which coincides with the moment in which the vehicle stops. For this purpose, a signal is periodically generated by the sensor means 150; interpretation of this signal determines the state of motion of the vehicle, which can be moving or motionless. If the signals that arrive from the sensor means 150 indicate that the vehicle is moving, the screen 120 displays, in the form of hours 121 and minutes 122, the current time measured by the device 110. When the signals that arrive from the sensor means 150 indicate that the vehicle has been stopped, the electronic control means 100 freeze the screen 120 on the value displayed at that moment.

[0019] The preferred embodiment of the device, shown here only by way of non-limitative example, has been studied for internal application to the front window of a vehicle, although obviously a different placement, such as for example on the dashboard or laterally in a visible position allowed by the road code, is fully equivalent and irrelevant for the purposes of the invention. As shown in Figures 2, 3 and 4, the device has a styling which, although not being essential for the purposes of operation, attracts attention to its function as a parking disk, which is highlighted by means of its color, by means of screen-printing and by means of the size of the digits. Furthermore, although the parking disk 200 can be fixed directly to the window of the vehicle, in the embodiment described here it can be inserted in a slider-like support 210 that allows to view the time from outside and at the same time allows to intervene easily on the device to adjust the time.

[0020] The body of the parking disk 200 is substantially constituted by two molded trapezoidal plastic parts that close with a snap action and support the printed circuit that bears the electronic components and the display means 120, whose screen, designated here by the same reference numeral, comprises at least four digits for displaying the time, understood in particular as hours 121, in 12-hour or 24-hour mode, and minutes 122. In addition to the wide opening constituted by the window itself of the screen, the device has in its front part hour adjustment buttons 143, minute adjustment buttons 144, a "forward" button 141 and a "back" button 142. These buttons are not visible from outside and can be actuated only by removing the clock from the slider-like support so as to avoid their accidental use.

[0021] Correct time setting occurs as follows: while keeping pressed the hour button 143 or the minute button 144, one acts simultaneously on the "forward" button 141 or "back" button 142 in order to cause the hours or minutes to increase or decrease. When the buttons are released, the new value that has been reached is stored. If malfunctions in the electronic circuits become apparent, a small hole 145 allows to reset the clock by acting for example with a pointed object.

[0022] As an alternative, in a more complicated embodiment of the time measurement device 110, a radio-frequency receiver is used to receive the exact time from any time signal provider. In this manner, time adjustment occurs fully automatically at the rates dictated by the time signal supplier and the buttons 143 and 144 are omitted.

[0023] The slider-like support 210 shown in Figure 2 is also molded from plastics and has low thicknesses

and great elasticity of its structure, which allow it to adapt easily to the different curvatures of windshields or other curved surfaces of the various vehicles for which it is intended. Two raised sides 211 are provided with teeth 212, shown in Figure 2 only on one of the two sides, on which the main body 200 of the automatic parking disk engages; by sliding in a slider-like fashion with a short stroke, said body effectively locks into an appropriately provided seat 213 that is preferably spherical and raised. In the central part of the slider-like support 210 there is a window 214 for viewing the digits shown on the screen 120 of the parking disk. A screen-printed film, coated with adhesive on both surfaces, allows bonding to the front part of the support and application to the window of the vehicle.

[0024] A significant part of the invention resides in the electronic system for freezing and unfreezing the time display and in the sensor means 150, which are capable of controlling the state of motion of the vehicle. With reference to Figure 5, these means preferably use a barium titanate ceramic piezoelectric sensor 151, formed by two mutually opposite elements of the bimorph type with high sensitivity and conveniently mass-calibrated, which detect the microvibrations induced in the structure by the running engine and/or by the motion of the vehicle. Commercially available bimorph sensors have a range of maximum sensitivity that can vary substantially, for example between 0.1 and 300 hertz. In this embodiment, a sensor has been used with frequency values between 0.5 and 50 hertz and acceleration values between 0.1 and 20 g along a substantially vertical axis of motion that lies at right angles to the direction of motion of the vehicle. The mass 155 fixed to the bimorph elements is preferably cylindrical, with a diameter of 4 mm.

[0025] In a second embodiment shown in Figure 7, the bimorph sensor 151 is replaced with a cylindrical or disk-like piezoelectric sensor 160 constituted by a main metal layer, preferably made of brass and with a diameter of 27 mm, on which there is a second ceramic circular layer which is rigidly coupled thereto and preferably has a diameter of 20 mm, and by a counterweight 161, which is also rigidly coupled to the metallic body and is arranged on the opposite base. In this embodiment, the counterweight 161 is shaped like a half washer that preferably has a weight of 4 grams.

[0026] Again with reference to Figure 5, the sensor 151 is inserted in a window 152 obtained by milling in a printed circuit 153, with which it is rigidly coupled by a tin soldering 154 used for the electrical connections of the signal. The dimensions of the seat therefore allow a predefined maximum movement, for example of ± 0.25 mm in a substantially vertical direction, allowing the assembly to withstand without damage violent impacts and sudden decelerations. In the preferred embodiments illustrated herein, the ceramic element practically has no yield in a horizontal direction. In this case, by using a single mobility axis, one obtains a device that has particular constructive simplicity, robustness and a very low cost. Obviously, it would be fully equivalent for the person skilled in the art to replace the single-mobility sensor with other sensors on different axes in order to detect in a different manner the movement of the vehicle or the running-engine condition.

[0027] Going back to the diagram shown in Figure 1, it is noted that all the functions are concentrated in a circuit of the ASIC (Application Specific Integrated Circuit) type. The figure also highlights the presence of an amplifier 105 with high input impedance for detecting the charges generated by the piezoelectric sensor or by the sensor means 150 in general. The amplification functions, where necessary, can of course be incorporated into the ASIC itself. The automatic parking disk is completely self-powered and is characterized by very low current consumption. The power supply means 130 can be constituted for example by one or more 1.5-volt silver oxide batteries, such as the model identified by the code LR44, allowing a life of more than 2-3 years. When the power supply means 130 are no longer able to supply sufficient power, the need to replace the battery is indicated on the display 120 by activating an appropriate message, for example "BATT". Again according to the preferred embodiment described here, the time measurement device is based on a quartz whose oscillation frequency is 32.768 kHz, capable of ensuring precision and stability with errors of less than one minute per month. On the display 120 there is also the ":" symbol 123, which separates the hours 121 and the minutes 122, and is made to blink at the rate of one beat per second. Finally, the output of the amplifier 105 for the charge generated by the piezoelectric sensor 151 is connected to a voltage comparator inside the ASIC 100. The threshold value of the comparator, which determines a greater or smaller sensitivity to vibrations, is adjustable over a preset range of values, for example 1 to 10, by means of the "forward" button 141 and the "back" button 142, described earlier with reference to the time setting function. Operating these buttons individually, i. e. without acting also on the "hours" button 143 and the "minutes" button 144, changes the sensitivity, which is initially preset to an intermediate value, for example 5, that is normally suitable to all vehicles. This feature has been introduced to support some particular situations: some particularly heavy or very quiet vehicles may in fact require a different adjustment of the sensitivity of the sensor. In order to facilitate adjustment, whenever the sensitivity is changed the new set value is shown on the display 120 for a few seconds.

[0028] Specifically with reference to the above described preferred embodiment, the operation of the automatic parking disk is therefore as follows. When the vehicle stops and the engine is switched off, the signal generated by the sensor 151 drops below the above mentioned comparison threshold, and the detected pulse density decreases sharply. The time display is frozen after a certain period, for example 30 seconds, during which no more than a certain number of pulses, for

example 15, must be detected. Once this condition has been ascertained, the time on the display 120 is frozen. Likewise, in order to restore the current time, the check is performed for another preset time period, for example 60 seconds, during which a certain number of pulses, for example 50, must be accumulated.

[0029] An operation that is particularly effective for checking the state of motion of the vehicle is obtained by using the method shown in Figure 6, i.e., by programming the microprocessor so as to act on timeslots with a duration extent T, where T is preferably equal to 8 seconds.

[0030] Detection on the part of the sensor of one or more pulses in three consecutive timeslots, for a total of 3T seconds, indicates that the vehicle is moving.

[0031] Likewise, the vehicle is considered motionless when no pulse is detected for a given number of consecutive timeslots.

[0032] The examples shown schematically in Figure 6 illustrate three different operating situations. In the first sequence, pulses in three consecutive timeslots out of four have been recorded and therefore the electronic control means classify the status of the vehicle as "moving". In the second sequence, pulses in three windows out of four have again been recorded, but not consecutively. The status of the vehicle, which is assumed to be motionless, therefore remains unchanged. If, however, as shown in the third sequence, at least one pulse is recorded in the subsequent timeslot, the "vehicle moving" condition is met and the electronic control means unfreeze the display of the current time.

[0033] In the preferred embodiment shown in the accompanying figures, the time is not visible inside the cabin; however, it is possible to display the time internally as well, simply by adding a second display on the rear side of the device, directed toward the inside of the cabin.

[0034] It has thus been shown that the present device achieves the intended aim and objects. In particular, an automatic parking disk has been obtained which is practical and easy to use, requires no additional electrical connection or the intervention of specialized technicians for its installation on the vehicle, is accurate, sturdy and very cheap. Clearly, numerous modifications are evident and can be promptly performed by the person skilled in the art without abandoning the scope of the protection of the present invention. For example, for the management of display freezing it is of course possible to use other types of sensor. By using the above described method, with particular reference to the system for detecting the state of motion of the vehicle based on timeslots, it is also possible, instead of detecting the vibrations induced by the motor or by the movement of the vehicle, to detect the presence on board of one or more people, for example by means of a pyroelectric sensor, commonly used in anti-theft devices or automatic door openers, or an infrared radiation sensor of the thermopile type, albeit with the already-cited disadvantages entailed by the use of said sensors, or again an ultrasonic motion transducer based on the Doppler effect, or any other type of sensor that does not require electrical connections to parts of the vehicle on which it is installed. Likewise, it is evident that the present automatic parking disk can be provided with a different type of time display, for example even with a device of the analog type, and that the means for fixing the parking disk to the windshield can be of any type that allows to display parking start time clearly and in a way that is easily visible from outside. The protective scope of the claims therefore must not be limited by the illustrations or by the preferred embodiments given in the description by way of example, but rather the claims must comprise all the characteristics of patentable novelty that can be deduced from the present invention, including all the characteristics that would be treated as equivalent by the person skilled in the art.

[0035] The disclosures in Italian Patent Application No. MI2000A002196, from which this application claims priority, are incorporated herein by reference.

[0036] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. An automatic parking disk, comprising power supply means, a time measurement device, means for displaying the measured time, and electronic control means comprising sensor means for detecting the state of motion of a vehicle, **characterized in that**:

   said power supply means are autonomous power supply means;
   said display means display:

   - the current time, if said sensor means indicate that the vehicle is moving;
   - the time when the vehicle was stopped, if said sensor means indicate that the vehicle is motionless; and **in that**

   said electronic control means:

   - activate freezing of the display after a time t1 for verifying the motionless state of the vehicle, and
   - activate unfreezing of the display after a time t2 for verifying the state of motion of the vehicle.

2. The automatic parking disk according to claim 1, **characterized in that** said display means comprise a liquid-crystal digital screen.

3. The automatic parking disk according to claim 1, **characterized in that** said sensor means comprise a piezoelectric sensor.

4. The automatic parking disk according to claim 3, **characterized in that** said piezoelectric sensor is a barium titanate ceramic sensor formed by two mutually opposite elements of the bimorph type.

5. The automatic parking disk according to claim 4, **characterized in that** the maximum sensitivity of said sensor has a frequency of 0.5-50 Hz.

6. The automatic parking disk according to claim 3, **characterized in that** said piezoelectric sensor is a cylindrical or disk-like sensor that comprises a first metallic layer, a second ceramic layer, and a counterweight.

7. The automatic parking disk according to claim 3, **characterized in that** the sensor is inserted in an opening obtained by milling inside a printed circuit to which it is rigidly coupled by soldering.

8. The automatic parking disk according to claim 3, **characterized in that** the dimensions of said window allow a maximum movement of ± 0.25 mm in a substantially vertical direction.

9. The automatic parking disk according to claim 3, further comprising means for calibrating said sensor.

10. The automatic parking disk according to claim 1, further comprising at least one of the following:

-- means for adjusting the current time;
-- means for resetting the device.

11. The automatic parking disk according to claim 1, further comprising means for automatic time adjustment driven by a radio-frequency time signal.

12. The automatic parking disk according to claim 1, further comprising a slider-like support.

13. The automatic parking disk according to claim 1, further comprising second display means for displaying the measured time on two opposite sides of the device.

14. The automatic parking disk according to claim 1, **characterized in that** said power supply means comprise at least one 1.5-V or 3-V battery.

15. The automatic parking disk according to claim 1, **characterized in that** said sensor means comprise at least one sensor selected from the group that includes:

-- a pyroelectric sensor;
-- a thermopile infrared radiation sensor;
-- an ultrasonic motion transducer based on the Doppler effect.

16. The automatic parking disk according to claim 1, **characterized in that** said times t1 and t2 are constituted by a series of timeslots with a duration T and **in that** the variation of the state of the vehicle from "motionless" to "moving" is determined when said sensor detects one or more pulses for a first predefined number of consecutive timeslots and the variation of the state of motion of the vehicle from "moving" to "motionless" is determined when no pulse is detected for a second number of consecutive timeslots.

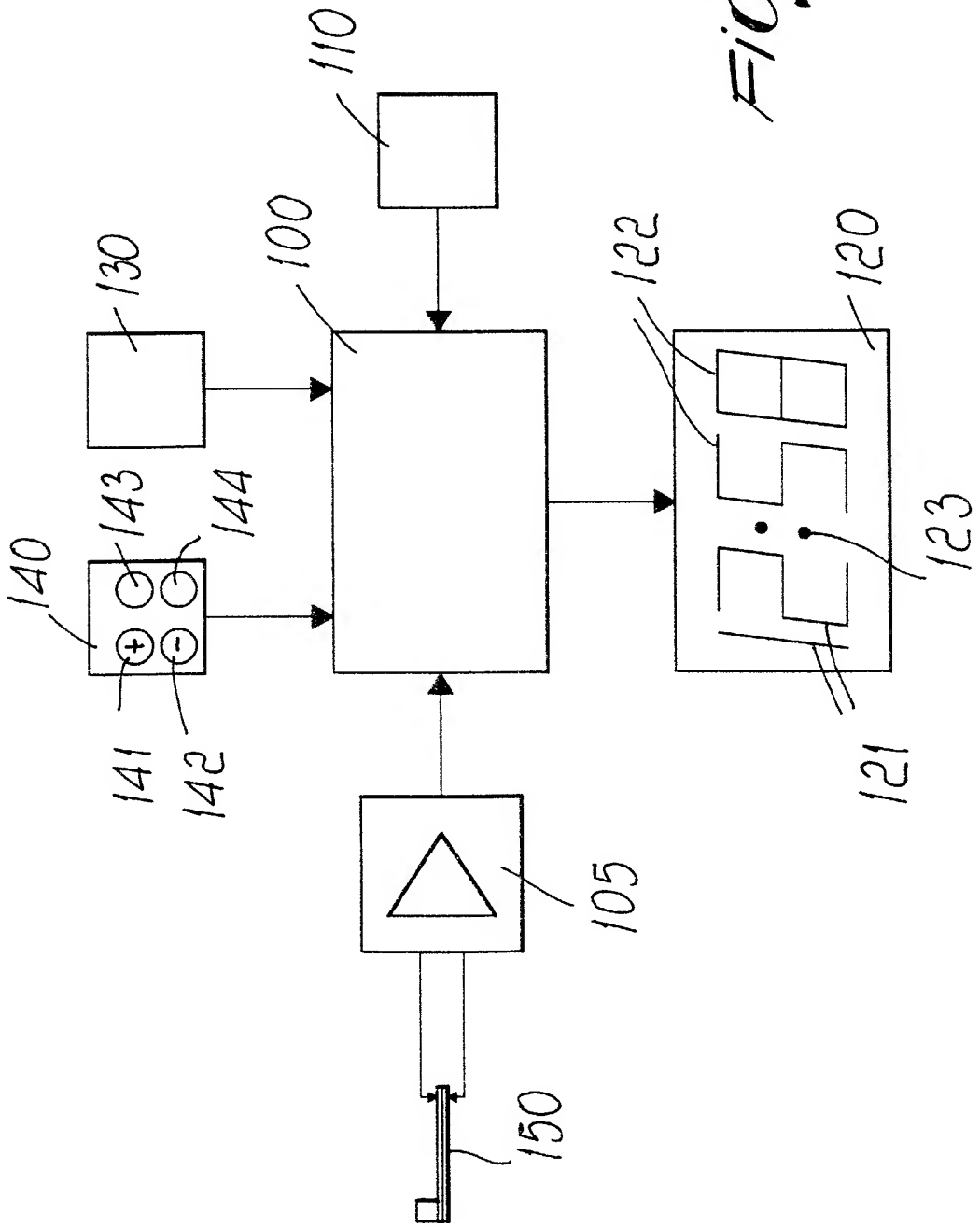

Fig. 1

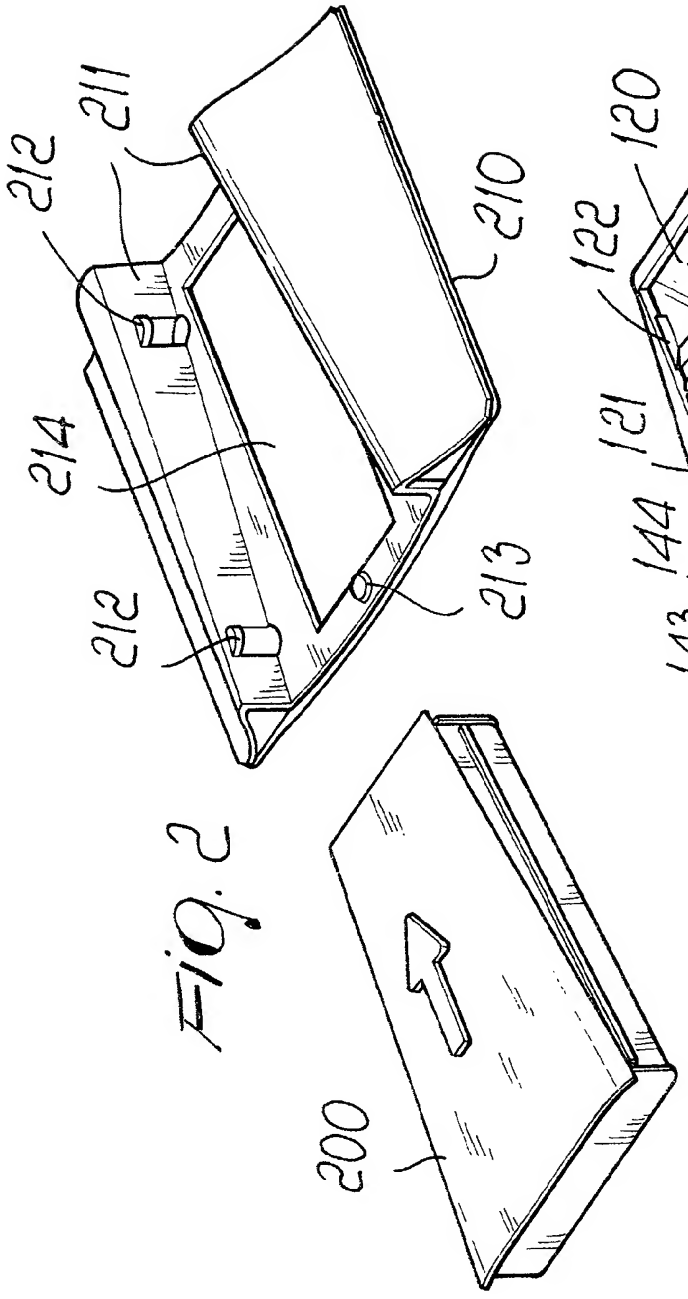
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Fig. 2

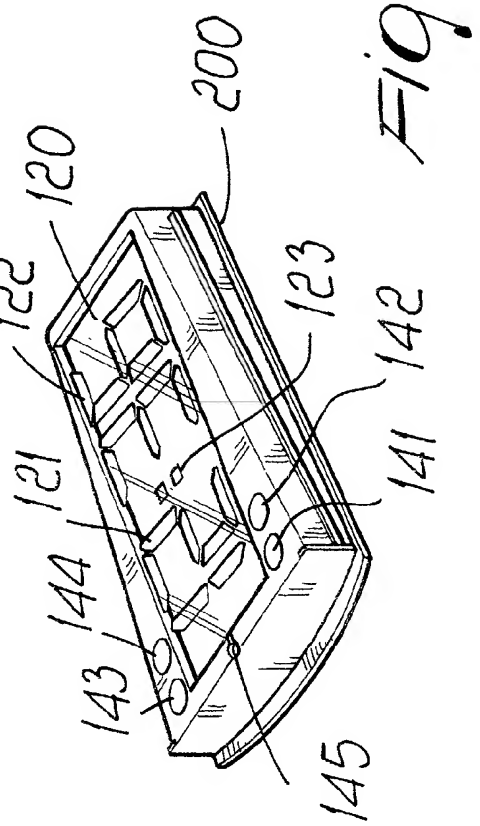
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Fig. 3

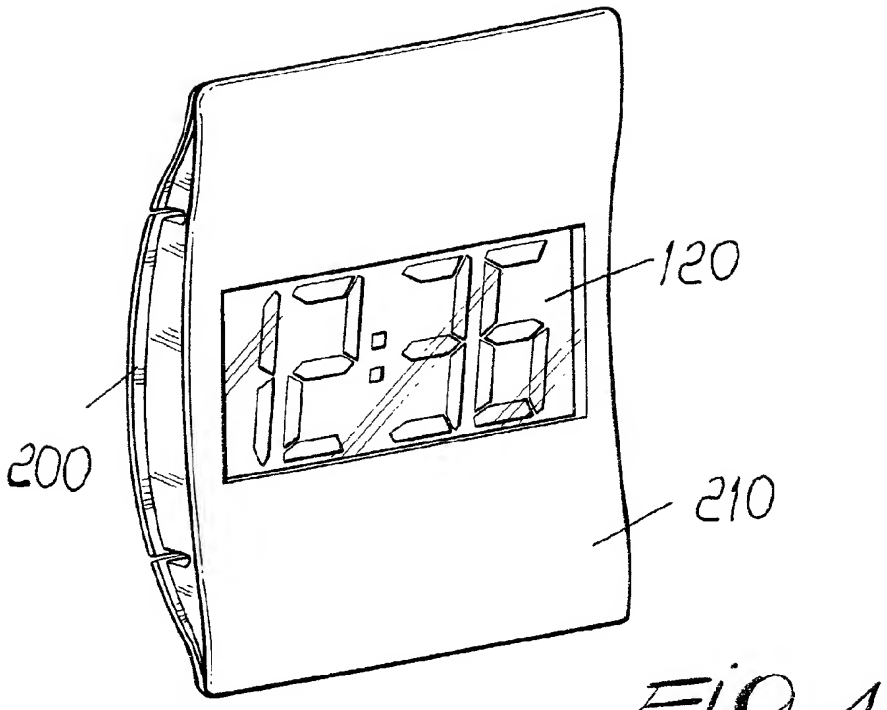

Fig. 4

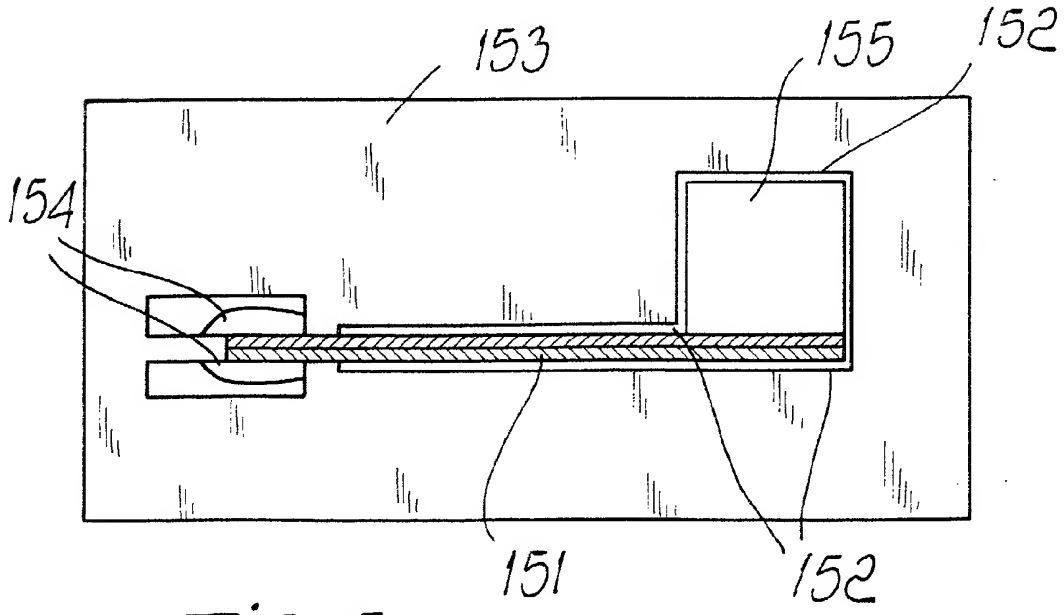

Fig. 5

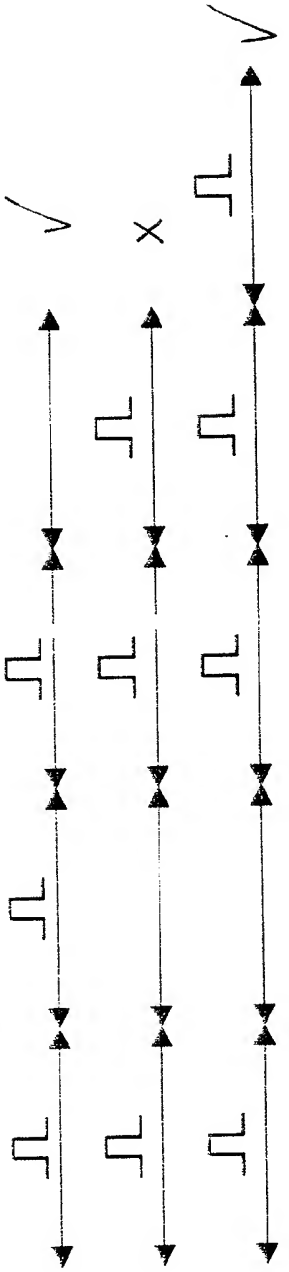

Fig. 6

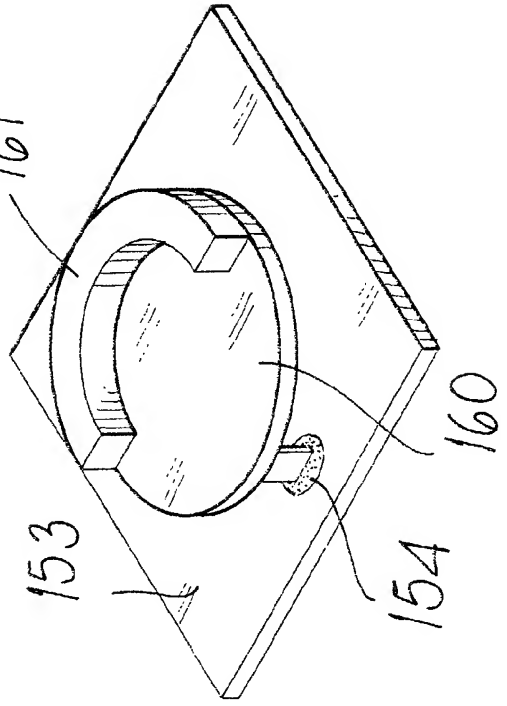

Fig. 7